



VATS's Modified CARP Protocol- Addition of Trendelenburg Position May Benefit the Severely Hypoxic Covid19 Patients

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Introduction:

COVID 19 led to substantial suffering of mankind with resultant millions of deaths, millions of job loss and trillions USD loss to the global economy and with its long term social and psychological impact which are unmeasurable considering that the direct and indirect cost involved and the livelihood of those whose family's suffered death.

The main pathophysiology is coagulopathy and the deposition of microthrombus leading to refractory hypoxia and with consequent very high requirements of oxygen to keep Spo₂ in normal range. As COVID infection primarily involve the dorsal and dependent region of the lungs due to high vascularity and hence more risk of thrombus formation in the dependent region, it was found that COVID Awake Repositioning/Proning Protocol (CARP) will be helpful temporarily as a bridge to avoid intubation and to buy time for the medicines to act. CARP positioning improves oxygenation in spontaneously breathing non-intubated patients with hypoxemic acute respiratory failure transiently and to a variable degree in different patients depending upon the area of lung involved.

Standard CARP protocol Indications [1]:

1. Isolated hypoxemic respiratory failure without substantial dyspnoea (the "paradoxically well appearing" hypoxemic patient).

For CARP protocol patient must meet the following criteria:

- Not in multi-organ failure, normal mental status,
- Mild to moderate COVID with expectant reversibility of lung injury to avoid intubation
- No hypercapnia or substantial dyspnoea
- No anticipation of difficult airway

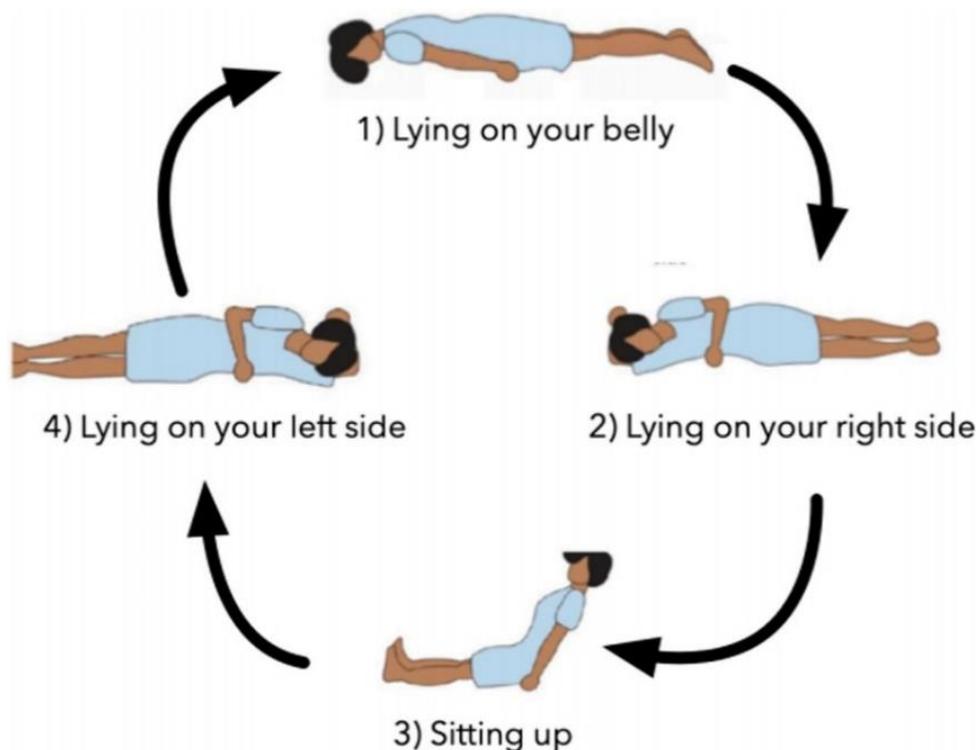


Image 1- Standard CARP protocol

However, those Patients who do not wish to be intubated. The main risk of awake proning is that it could cause excessive delays in intubation but in these patient who are reluctant for intubation, trial of awake proning may help transiently.

Contraindications for CARP protocol: severe COVID with a PF Ratio (po_2/Fio_2) of <100 on Non-Invasive Ventilation (NIV) are not suitable candidates.

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CARP timings and protocols: Patients should prone, as tolerated for 2-4 hours in each position for initial 2-4/days or till hypoxemia improves.

CARP Protocol Timed Position Changes Every 2 hrs, in following position

1. Left Lateral Recumbent
2. Right Lateral Recumbent
3. Sitting Upright 60-90 degrees
4. Lying Prone in bed,

Ensure that patient is getting required flow and FIO2 based on the severity of disease and we can ask patient to move to a different position which may increase his Spo2

If some patients are still not responding to standard CARP protocol, then Trendelenburg position (Supine, Bed 30 degrees Head Down under strict observation of staff) 10-15 Minutes after each position change with Spo2 Monitoring.

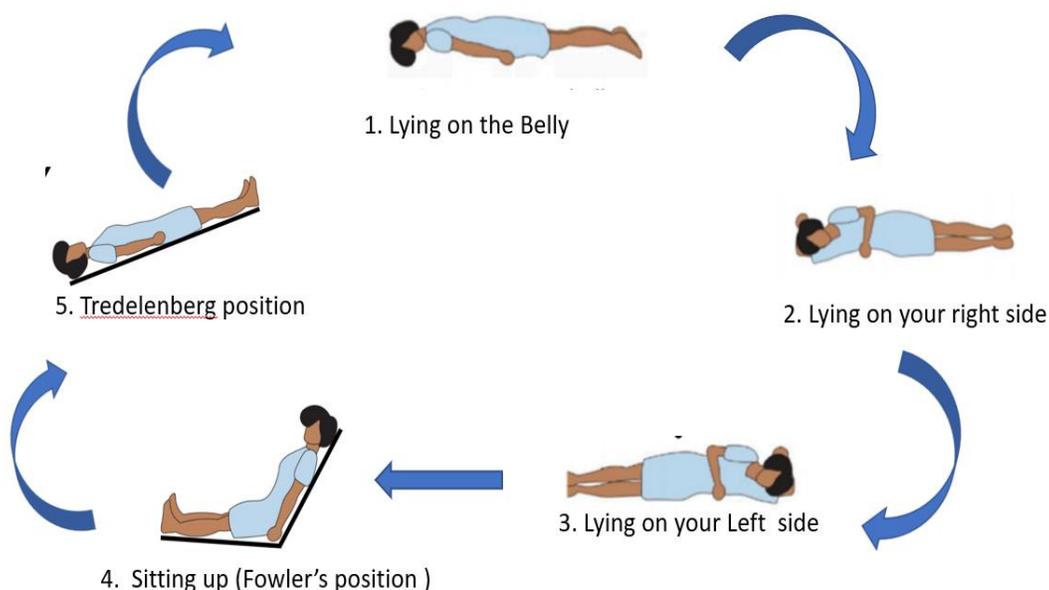


Image 2- Modified VATS's CARP protocol

Rationale to Include Trendelenburg position in the Modified Vats's CARP protocol is that COVID 19 disease primarily involves dependent, dorsal zone and peripheral lung involvement with relative sparing of perihilar region and apex (Vats's Reverse pulmonary edema sign on the chest X ray) [2] although on HRCT scan it may show more involvement of lung parenchyma showing ground glass opacities. As we

know from the pulmonary physiology that lung apex has high V/Q ratio with more ventilation and less perfusion and blood is the oxygen carrying media to all body parts.

Apical lung area is easily expandable because its non-diseased or minimally diseased and there are no restrictions of expansion as for the lower parts of lungs which are already diseased and lower lobe excursion are compromised by the diaphragm, pleural effusion and obesity or any other abdominal pathology hence when the patient assumes Trendelenburg position pulmonary blood flow is getting directed to the apex due to gravity and when admixture with healthy lung leads to better V/ Q matching and increase in oxygenation because in this position both ventilation and perfusion in apex are high and blood can have better oxygen carrying capacity , hence regular or intermittent inclusion of Trendelenburg position may help in helping hypoxic patients with the hope of avoiding intubation.

Discussion

CARP protocol has been found very effective in COVID19 hypoxemia with the strong physiological and scientific evidence and laboratory basis and in fact this technique is successfully being used in millions of patients and benefitted them. More importantly, many of intubations were avoided considering the approach that gives temporary improvement in hypoxemia pending the natural course of COVID completes

Message : Most Cases of COVID are reversible with the help of multiue of modalities including immunity, disease severity , underlying comorbidities and medicine primarily antocoagulants and steroids and symptomatic medicine with oxygen supplementatinn. Hence the best approach seems : “Give the time for lung to heal with the above said managemnet, till then support the lungs and by oxygen and standard CARP protocol” in mild to moderate cases. Modified Vats’s CARP protocol can be used in selected patients who are severely hypoxemic and may benifteed with tredenlenberg position for 15 to 20 minutes after every position change with adequate monitoring or in a sequential way as shown in image 2

Reference:

1. https://nmc.gov.in/public/upload/download/79391_Treatment_Protocol_15-4-2020.pdf
2. Mayank Vats and Spraha Vats. “New Entity Accounting for Reverse Pulmonary Edema: A Characteristic Radiological Finding in COVID-19”. EC Pulmonology and Respiratory Medicine 9.7 (2020): 33-42.